DEVELOPMENT OF JACKET PATTERNS FOR TEENAGERS USING OPTITEX FLATTENING MODULE

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Abstract: Adolescence is a period of transition from childhood to adulthood, defined by major changes in physical, behavioural and social plan. The interest of teenagers for computer technology is in a perpetual growing and shopping online is one of their favourite activities. The garment industry is extremely competitive in terms of virtual simulation, consisting of 3D virtual bodies, virtual garments and virtual try-on systems.

The paper presents the advanced method of designing 2D patterns, started from the 3D surfaces, obtained by real scanning of several teenager bodies. The development of a jacket model for girls, by using Optitex software with its high-performance modules 3D Flattening, 3D Simulations and PDS, based on the anthropometric standard for children, SR 13546: 2012, will be presented. These modules enable the designer to preview the shape of the product and its fitting to the body dimensions, which offer the possibility of developing to an infinite number of clothing collections just by changing the characteristics of the material, various seams, accessories or colours.

Keywords: anthropometric standard, basic pattern, 3D flattening, jacket for girls, 3D simulation

1. INTRODUCTION

Currently, most teenagers are users of computer technology. Online shop become more and more used by them, especially since they are also very interested in their physical appearance. From this point of view, the aim of the garment companies is to attract them as customers. In order to comply with customer preferences, the garment producers take into account two important aspects: the design and the fit. To achieve these two components, a complex process of product development is required, but even so, the results of the sales volume remain uncertain. A successful alternative in presenting the design of the clothing product, as well as evaluating the fit of the selected item, is the development of this process as a virtual one. The advanced systems for 3D design and body measurement, open a new door for researchers and specialists to provide a better comfort and fit and even to gain a new level of customization, especially in the field of garments [1,2].

The processing of patterns for garments can be obtained by various methods, generally classic geometric design, which is the basis for designing patterns in different specialized software. Currently, a garment can be developed using existing high-performance tools such as: garment design software, 3D scanning for anthropometric data collection and 2D/3D simulation, modelling and fitting software [3]. The final product ready for launch in production goes through a complex process of design, sampling, and validation, meticulous steps that are time, energy and material resources consuming. By using the pattern

processing method with 3D Flattening module from Optitex PDS design software and 3D simulation, the resources consumption is considerably reduced and the final quality is superior. Applying the specific functions of the module, the surface of the 3D object is converted in a 2D surface, respectively the human body on which the contour of the desired product is drawn. The result is a very accurate pattern – human body correspondence. The patterns are actually obtained from the unfolded surface of the body. Another advantage of this processing method is the direct visualization on the body model of the sewing lines between the product components, the shape of the product and the desired length. Surfaces are displayed in the PDS pattern processing window. These are the result of drawing the contour lines between anthropometric points necessary for the pattern, using the geometric method. The contour can be resized by modifying the main segments with a specific constructive addition, according to the product type, material type and product destination. Depending on the positioning on the body, garments are divided in two main categories: products with shoulder support (shirt, blouse, shirt and jacket) and products with waist support (tights, pants and skirt). The proposed method can be applied for obtaining basic patterns for both categories.

2. GENERAL DATA AND STEPS OF THE PROPOSED METHOD

The most important biological changes of the human body begin during adolescence. Thus, to girls who have reached the age of 14, the breast continues to develop and the hips get wider. To boys, the features of maturity appear 1 year later, around age 15. During this period, the waist is clearly pronounced for both, boys and girls. The proportions of adolescents' bodies are close to those of adults [4]. Product development for the 14- to 18-year-old age group, especially girls, is a difficult process due to these continuous body changes, very difficult to standardize. The anthropometric standard for children, SR 13546: 2012 – Clothing. Body dimensions for children between 6 and 19 years old [5], elaborated by INCDTP (table 1), provides a solid anthropometric database for garments development.

Table 1. The main standardized anthropometric dimensions for girls [5]

Girls age groups	Body height (cm)	Bust circumference (cm)	Hip circumference (cm)
14-15 years	152	85	91
	158	87	93
	164	89	95
	170	92	98
16-18 years	152	88	93
	158	89	95
	164	91	97
	170	92	99

Based on the information regarding lengths, dimensions, circumferences, conformations, the virtual mannequin is generated according to the type and dimensions from the corresponding age category. For girls, compared to the boys, due to the appearance of the breasts, additional anthropometric dimensions are needed to characterize this area.

The method consists in processing the flattened surfaces of a 3D product.

The first step to obtain the basic patterns for teenager's garments is to parameterize the virtual mannequin, by setting the values of different anthropometric dimensions (i.e., lengths and circumferences) in the "Model properties" window (figure 1).

Figure 1. Application of standardized anthropometric dimensions for:
a - lengths; b - circumferences

By changing the anthropometric dimensions parameters in the „Model properties” window, the mannequin can be shaped in different sizes and conformations, which leads to the elimination of the pattern grading operation (figure 2) [6,7].

Figure 2. Marking in the waist area for two mannequins of different sizes

The process of obtaining 2D patterns from the 3D surface consists of the following steps (figure 3):

- creating standardized mannequins;
- placing the marking points on the virtual body using the “Draw Path” function;
- drawing the corresponding contour;
- extracting the resulted surface using the “Build Patch” function;
- checking and processing the contour of 2D surfaces;
- obtaining the desired pattern by adding constructive additions.

Figure 3. Steps for obtaining 2D patterns from the 3D surface

In parallel with the process of obtaining the patterns, the product is simulated on the virtual mannequin, thus having a real image of it. A virtual collection can be developed by changing materials and accessories directly in the software (figure 4).

Figure 4. Simulated garment on virtual mannequin

3. PROCESSING THE BASIC PATTERNS OF GIRLS JACKET

The jacket for teenagers can be the first or second layer on the body. The jacket for girls is designated for school activities or social events. The silhouette of the product is semi-adjusted, the basic pattern is composed of two front parts, two front side parts, two back parts, two back side parts and two sleeves formed by front and back parts. The bottom edge of the jacket corresponds to the hip line, and the bottom edge of the sleeves with the wrist line. In order to obtain the flattened surfaces, the marks corresponding to the main anthropometric points have to follow the below body parts, placed on the mannequin (figure 5):

- for the front: the circumference of the base of the neck, the cut of the sleeve, the waist, the hip and the nipple;
- for the back: the circumference of the base of the neck, the cut of the sleeve, the waist, the hip and the prominence of the shoulder blade.

Figure 5. Placing contour points

The placed points are joined together by contour lines and the body surface become flattened with “Build patch” function support (figure 6).

Figure .6 Flattening operation of 3D surfaces

Successively, contoured surfaces can be developed for all types of age groups for adolescents.

4. 3D SIMULATION AND VIRTUAL MODELLING OF THE JACKET

3D simulation and virtual modelling of a garment has the purpose to check the product - body correspondence and correct any technical issue. To obtain an image as close as possible to the reality of the garment, the 3D simulation and modelling is applied directly on the parameterized body, using the standard anthropometric values and the properties and appearance of the materials. Compared with the classic development of a product, this method saves the time and related costs of stages like model execution, prototyping and zero series execution.

The following steps are necessary to elaborate the basic patterns, using the 3D Optitex software parameterized mannequins:

- **Step 1.** Applying assembly directions between pattern parts: the sewing lines are defined with the help of the “Stitch” function.
- **Step 2.** Placing the patterns on the parameterized mannequin: the patterns must be replaced from the PDS work area to the 3D work area of the PDS program, by using

"Place cloth" button, which requires first to synchronize the patterns with the mannequin's position (figure 7).

Figure 7. Applying assembly directions between pattern parts

- **Step 3.** Processing the simulation stage: Once the way of assembling the parts is correctly implemented, the simulation stage can start. The duration of the simulation process varies depending on the number of marks placed in the 3D simulation window, the complexity of the simulated model and the number of stitches (figure 8).

Figure 8. 3D simulation of the jacket

- **Step 4.** Checking the body-product correspondence: one of the multiple options offered by Optitex PDS, is to check the correctness correspondence between the body and the designed product, by using the “Tension map”, which indicates essential aspects regarding the necessary distance between the body and the product and the degree of comfort. 3 different colours are displayed on the virtual mannequin, as so (figure 9):
 - Red: indicates an increased pressure of the product on the body;
 - Green: a comfortable pressure (comfort zone);
 - Blue: lack of the tension of the product on the body.

Figure 9. Visualization of the tension maps

- **Step 5.** Modifying patterns in non-conformities areas: in the Optitex PDS software, the patterns can be modified by moving the main points or correcting the contour. These changes are made simultaneously on the simulated product.

- **Step 6.** Repeating steps starting with step 3, after changing the patterns.

This method can be easily applied in the same sequence for any type of product. In our study, the basic patterns for the jacket product were obtained for the type dimensions 152, 158, 164, 170 for the two age groups, 14-15 years and 16-18 years (figure 10).

Figure 10. Basic patterns by type dimensions and age groups

5. CONCLUSIONS

The paper presents the method of pattern processing for girls jacket having as information the anthropometric data and the necessary knowledge for the garments design, from 3D body surfaces by using the Optitex Flattening module. This advanced method can be applied to all types of products and categories of people. The process of obtaining basic patterns by this method has the following features and advantages:

- the use of specific anthropometric dimensions, depending on the category destination and type of the product;
- developing algorithms for basic patterns;
- fitting the product on the parameterized virtual mannequin;
- visualizing the sewing lines for the product, its shape directly on the virtual body and correcting any non-conformities, through the “tension map” that express the distance between the body and the product in different areas;
- development of very precise patterns in a short time;

- creating virtual collections using various fabrics, accessories and colours.

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